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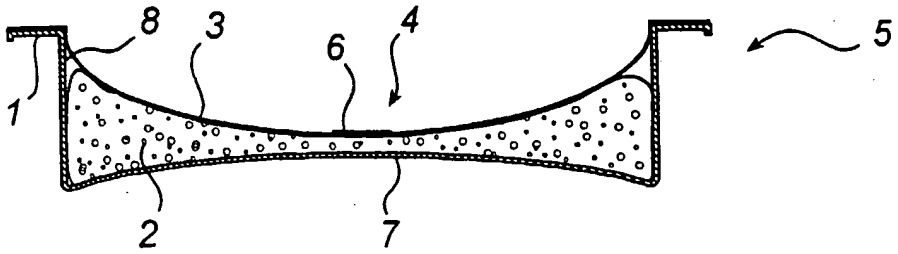
(54) Title: FOOD PACKAGING METHOD



(57) Abstract: A method of pasteurising and vacuum packing food (2), comprising the steps of placing the food (2) on a tray 81) having a flexible bottom (7) and stiff lateral walls (8) extending in the vertical direction of the tray (1), up to a filling degree of 410-60% of the maximum volume of the tray (1), covering the tray (1) with a flexible cover layer (3) to form a package, providing a one-way valve (4) for one-directional communication from the interior of the package (5) to the exterior thereof, pasteurising the contents inside the package (5) thus formed by means of microwaves, closing the valve (4) upon completed pasteurisation of the package and cooling the package 85), whereby a vacuum is created in the package (5) in such a manner that the package (5) with the vacuum-packaged food (2) therein presents a centre portion where the distance between said flexible cover layer (3) and said bottom (7) is shorter than the distance between said flexible cover layer (3) and said bottom (7) at the peripheral edges of the package.

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FOOD PACKAGING METHOD

Technical Field

The present invention relates to a method of pasteurising and vacuum-packing food and to a package to be used in the implementation of said method.

Background of the Invention

When ready-to-eat factory-prepared dishes are to be heated in microwave ovens, the package contents will as a rule be unevenly heated. One manner of remedying this drawback is to arrange a material of a special kind in the package in those portions of the package contents that normally are heated to a lesser degree than other portions. This special material is chosen for its capacity to improve absorption of the microwaves and consequently the package contents located in the area where the special material is present are heated indirectly via the high-absorption material. One alternative is to use materials that rather than absorbing microwaves actually prevent such waves from reaching their target. This kind of material therefore is positioned in the area of the package that normally receives most heat. Packages fitted with integrated special materials obviously are more expensive to produce while at the same time they add to the complexity of the manufacturing process.

Furthermore, the keeping qualities of ready-to-eat food kept under refrigeration are limited in the case of traditionally packaged heat-and-eat dishes. The prepared food is transferred to packages, which are then subjected to a vacuum pressure, alternatively are filled with an inert gas, such as carbon dioxide. Vacuum-packing often is not sufficient to ensure the keeping qualities of the ready-cooked food inside the package over longer periods. The transfer of the ready-cooked food onto the package

also puts the food into contact with the surrounding air, which further shortens the period of freshness of the food.

Summary of the Invention

The object of the present invention thus is to provide a method of packing food, and a package used to implement said method, thus providing a solution to the problems outlined in the introduction.

This object is achieved in accordance with the invention by means of a method possessing the characteristics defined in the appended claim 1, preferred embodiments being defined in the appended claims 2-4. The object is also achieved by means of a package as defined in the appended claims 5-12.

The inventive method of pasteurising and vacuum packing food comprises the steps of placing the food on a tray having a flexible bottom and stiff lateral walls or rims extending in the vertical direction of the tray, up to a filling degree of 40-60% of the maximum volume of the tray, covering the tray with a flexible cover layer to form a package, providing a one-way valve for one-directional communication from the interior of the package to the exterior thereof, pasteurising the contents inside the package thus formed by means of microwaves, closing the valve upon completed pasteurisation of the package and cooling the package, whereby a vacuum is created in the package in such a manner that the package with the vacuum-packaged food therein presents a centre portion where the distance between said flexible cover layer and said bottom is shorter than the distance between said flexible cover layer and said bottom at the peripheral edges of the package.

Because the transfer of the food to the package takes place prior to the pasteurisation step, the risk of contamination of the food is reduced. The pasteurisation takes place under excess pressure inside the package, and

it is mostly vapour that exits through the valve. As the heating stops, the valves closes and the package is cooled, whereby a vacuum is created inside the package due to condensation. Since the package is formed with a flexible bottom and since also the cover layer is flexible, the package will, once a vacuum is established inside the package, have a distance from said flexible cover layer to the flexible bottom that is shorter than the height of the lateral edges. When the packaged food is to be prepared for consumption or be heated, this difference in distance will result in the food in the package being evenly heated, since more microwave energy will be supplied to the edges, where the quantity of food is the largest, and less energy be supplied to the middle, where there is less food. In conventional packages for ready-to-eat dishes the distance between the cover layer and the bottom is equal throughout the entire package.

Preferably, the one-way valve is provided on said flexible cover layer. This arrangement presents the advantage of preventing any food from blocking the valve, since during heating the vapour then being generated will lift the cover layer to a level above the food.

In order to simplify the manufacturing process, the valve preferably is arranged on the flexible cover layer before the latter is applied on top of the tray.

In accordance with a preferred embodiment of the present invention the food includes all ingredients necessary for a ready-to-eat dish. This means that only heating of a package holding all ingredients is required to obtain a ready meal.

Preferably, the tray has a convex shape as seen from below during the filling and pasteurisation steps, whereas the finished package with the food therein, i.e. when a vacuum pressure exists in the package, the bottom of the tray has a concave shape as seen from below. The advantage gained by imparting to the tray a basically convex shape as seen from below is that it eliminates the

risk that the food will "jump" off the tray. Since the basic shape of the tray is such that it comprises a concave bottom (as seen from below), it tends to resume its shape. As a result, should a tray of such originally concave shape for some reason, for example after the final heating, still have a convex shape, there is a risk that suddenly it will resume its original position, i.e. the bottom will bulge upwards into the tray and any food therein may "jump" off the tray, if the covering film has been removed.

Preferably, the bottom of the tray presents one section that is essentially flat. Since the bottom of the tray has a convex shape as seen from below the package/tray will be able to rest steadily supported on its flat section. According to one preferred embodiment this flat section forms more than 40% of the total area of the bottom.

In addition, the valve preferably consists of a slit formed in said flexible cover layer and a reclosable adhesive film extending across the slit. The adhesive preferably is adapted for a suitable magnitude of opening resistance, i.e. the valve will open in response to a predetermined excess pressure inside the package. Because the valve has a predetermined resistance to opening, the heat spreads more efficiently, since vapour from those portions of the food enclosed in the package that are heated most spreads over the entire package interior, thus heating the colder food portions. A valve of this kind also possesses the advantages of being simple, inexpensive to produce, requiring little space and may be used to display e.g. informative texts, lists of contents, and so on. By configuring the valve in a particular way it is likewise possible to make the valve emit a sound signal as vapour is flowing through the valve. The magnitude of the resistance to opening may be adapted to permit the valve to open only when the heating of the contents inside the package is completed, in which case

the signal therefore indicates that the heating of the contents is completed.

In accordance with one preferred embodiment the section of the tray that is located at the peripheral edge of the bottom is at an angle to the direction of extension of the tray. The transition from these oblique sections to the flat section of the bottom forms so called flex edges or alternatively one flex edge about which flex edge(s) the flat bottom portion may move relative to the oblique or slanted portion close to the peripheral edges of the bottom. This solution allows continuous flexing of the bottom of the tray.

Brief Description of the Drawing Figures

The invention will be described in more detail in the following by means of one embodiment with reference to the accompanying drawings, wherein:

Figs 1a-1f illustrate the method of pasteurising and vacuum-packing food in accordance with the present invention.

Figs 2a-2b illustrate the package during the final heating.

Fig 3 illustrates one example of a production line that may be used in the implementation of the method in accordance with the present invention.

Figs 4a-4b are perspective views of the tray as seen obliquely from below, illustrating the latter in a normal-condition stage and a vacuum-condition stage, respectively.

Description of Preferred Embodiments

Fig 1a illustrates a tray 1, which is filled with the desired food 2, Fig 1b, to a filling degree of about 40-60%, depending on the kind of food 2 to be packed. Fig 1c shows the manner of application on the tray 1 of a flexible cover layer 3 fitted with a one-way valve 1. The package 5 thus formed is then exposed to the effects of

microwaves whereby the food 2 is pasteurised, Fig 1d, and the valve 4 permits vapour to exit from the package 5. The valve 4 is in the form of a tape applied across a slit made in the flexible cover layer 3. At the same time as the heating by means of the microwaves ceases, the valve 2 closes, see Fig 1e. Preferably the movable part 6 of the valve 4, i.e. the adhesive layer 6, is designed to automatically reclose the valve, when the heating ceases and the excess pressure inside the package 5 decreases somewhat. Alternatively, this effect could be achieved by purely mechanical means that close the valve 4 as the package is being conveyed on a production line. Owing to the condensation arising inside the package 5 a vacuum pressure is generated therein, see Fig 1f. The effect of the combination of a predetermined degree of filling of the package and the fact that the bottom 7 of the tray 1 and the cover layer 3 are flexible is that in the centre part of the package 5 the distance between said flexible cover layer 3 and said bottom 7 will be shorter than the distance between said flexible cover layer 3 and said bottom 7 in the peripheral parts of the package. The tray 1 preferably is formed with rigid lateral rims 8, such that the change of volume consequently will be caused by to the bottom 7 and the flexible cover layer 3.

When a package 5, prepared by implementation of the method set forth above, is to be heated preparatory to final consumption of the food 2 enclosed in the package 5, the latter is positioned inside a microwave oven. After a while vapour generates inside the package and it spreads, see Fig 2a, therein, thus contributing to heating the food evenly. The design of the package 5, with a package centre that is thinner than the package edges, furthermore attributes to the food being heated more evenly, since in a conventional microwave oven the microwaves are concentrated to the edges of a package. Preferably, the valve 4 is adapted to open when the food 2 inside the package 5 has reached its fully heated state.

In accordance with a preferred embodiment of the present invention the valve 4 is designed to emit a sound signal when vapour flows through the valve 4, see Fig 2b. In other words, the sound signal indicates that the contents of the package are ready to be consumed.

Fig 3 shows one example of a production line 9, comprising a conveyor belt 10, a cover layer applicator 11, a microwave tunnel 12 and a cooling tunnel 13. A tray 1, filled with food 2 to the desired filling degree, is placed on the belt 10. A flexible film or cover layer 3 is applied on top of the tray 1 in the cover layer applicator 11 and thereafter the package 5 thus formed is introduced into the microwave tunnel 12, wherein the food 2 contained in the package 5 is pasteurised. When the package 5 enters the microwave tunnel 12 the valve 4 formed in the package is closed. The food 2 is heated inside the microwave tunnel 12 and the pressure gradually increases, until it exceeds a predetermined value in response to which the valve 4 is arranged to open. The residence time in the microwave tunnel 12 is set to ensure achievement of optimum food-pasteurisation results. At the end of the microwave tunnel 12, the valve 4 closes. The package 5 with the thus pasteurised food 2 contained therein is forwarded to the cooling tunnel 13, wherein the contents of the package 5 condenses, whereby a vacuum pressure is generated. The package 5 is now ready for further distribution to selling points. It is thus possible to use the method in an industrial process with the advantage of it being a continuous process. The time required for packaging inclusive of preparation (pasteurisation) of the food amounts to some minutes. In comparison with conventional methods on the market, the time requirements for the steps of pasteurisation and vacuum-packing of food in accordance with the present invention are but a fraction of the time necessary in conventional methods and in addition the food-keeping qualities are higher.

Fig 4a shows a tray 1 is a perspective view as seen obliquely from below under conditions of equal pressure around the tray 1. One section 14 of the bottom 7 of the tray is flat. The flat section 14 gives the tray 1 sufficient stability to allow the food to be eaten straight from tray 1. When a vacuum pressure is present in the package 5, as shown in Fig 4b, said flat section 14 and adjoining sections have bulged upwards into the package. Also in this condition the package 5 assumes a stable position but now it rests on the edges surrounding the bottom 7 of the tray 1, because of the stiffness of the walls or rims 8 of the tray 1. Owing to this design of the tray 1, the latter becomes stackable, both when it is used as a part of the package 5 and when stored prior to use.

As should be appreciated, numerous modifications of the embodiment described above are possible within the scope of protection of the invention as the latter is defined by the appended claims. For example, as described above a valve comprising a diaphragm and a diaphragm holder could be used. The flat section 14 of the bottom 9 of the tray 1 could, as an alternative, have for example a corrugated structure or a similar structure, provided that the sections of the bottom 7 in contact with the supporting surface impart stability to the tray 1. Furthermore, a tray 1 could of course be divided into several compartments, vegetables for instance being contained in one compartment, sauce in another, and so on. The invention has for its primary object to suggest methodical means for the pasteurisation and the vacuum-packing of food in containers of a size suitable for heating in conventional microwave ovens for home use. Consequently, it is of course possible to apply the method on larger-size packages for institutional catering kitchens, wherein the packages used are too large to be accommodated in conventional home-use microwave ovens. Cooling of the package following the pasteurisation step

could be passive, i.e. the package may be left to cool in ambient temperatures. For rapid processes it is, however, preferably to cool actively, for example in a cooling tunnel as described above.

CLAIMS

1. A method of pasteurising and vacuum packing food (2), comprising the following steps:
placing the food (2) on a tray (1) having a flexible bottom (7) and stiff lateral walls (8) extending in the vertical direction of the tray (1), up to a filling degree of 40-60% of the maximum volume of the tray (1); covering the tray (1) with a flexible cover layer (3) to form a package (5); providing a one-way valve (4) for one-directional communication from the interior of the package (5) to the exterior thereof; pasteurising the contents inside the package (5) thus formed by means of microwaves; closing the valve (4) upon completed pasteurisation of the package and cooling the package (5), whereby a vacuum is created in the package (5) in such a manner that the package (5) with the vacuum-packaged food (2) therein presents a centre portion where the distance between said flexible cover layer (3) and said bottom (7) is shorter than the distance between said flexible cover layer (3) and said bottom (7) at the peripheral edges of the package.

2. A method as claimed in claim 1, wherein the one-way valve (4) is arranged on said flexible cover layer (3).

3. A method as claimed in claim 2, wherein said one-way valve (4) is applied on said flexible cover layer (3) during the step of covering said tray (1) with the flexible cover (3).

4. A method as claimed in any one of the preceding claims, wherein said food (2) includes all ingredients necessary for a ready-to-eat dish.

5. A package (5) for use in a method of pasteurisation and vacuum-packing food (2), said method comprising the steps placing the food on a tray (1) up to a filling degree of 40-60% of the maximum volume of the tray (1), covering the tray (1) with a flexible cover layer (3), providing a one-way valve (4) for one-directional communication from the interior of the package (5) to the exterior thereof, pasteurising the contents inside the package (5) thus formed by means of microwaves, closing the valve (4) upon completed pasteurisation of the package (5) and cooling the package (5), whereby a vacuum is created in the package (5), c h a r a c t e r i s e d in
that the tray (1) has a flexible bottom and rigid lateral walls (8) extending in the vertical direction of the tray (1), said package (5) with vacuum-packaged food (2) contained therein presenting a centre portion, where the distance between said flexible cover layer (3) and said bottom (7) is shorter than the distance between said flexible cover layer (3) and said bottom (7) at the peripheral edges of the package (5).

6. A package (5) as claimed in claim 5, wherein the bottom (7) of said tray (1) has a convex shape as seen from below, when the pressure inside the package (5) exceeds or equals the pressure exteriorly thereof.

7. A package (5) as claimed in any one of claims 5 and 6, wherein the bottom (7) of the tray (1) is formed with a section (14) that is spaced from the periphery of the bottom, which is essentially flat.

8. A package (5) as claimed in claim 7, wherein said section (14) forms more than 40% of the total area of the bottom (7).

9. A package (5) as claimed in any one of claims 5-8, wherein the valve (4) is arranged on said flexible cover layer (3).

10. A package (5) as claimed in claim 9, wherein said valve (4) consists of a slit formed in said flexible cover layer (3) and of a reclosable adhesive film (6) extending across the slit.

11. A package (5) as claimed in any one of claims 5-10, wherein the valve (4) is arranged to emit a sound signal when vapour is flowing through said valve.

12. A package (5) as claimed in any one of claims 5-8, wherein the tray part located at the periphery of the bottom (7) extends at an angle to the direction of extension of the tray.

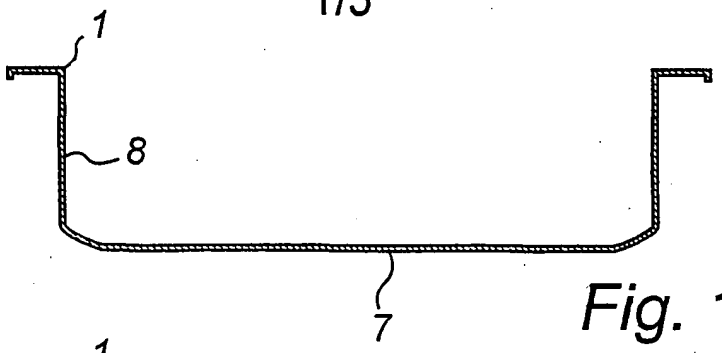

Fig. 1a

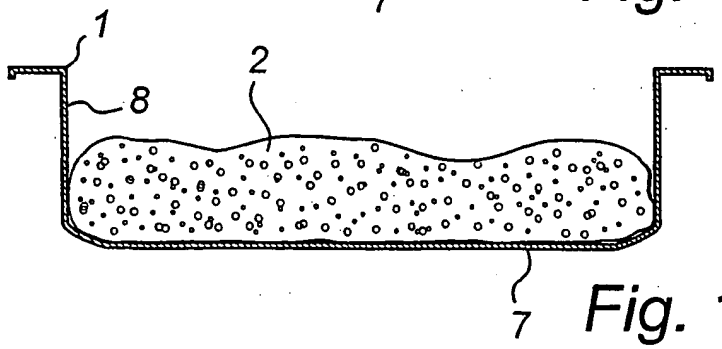

Fig. 1b

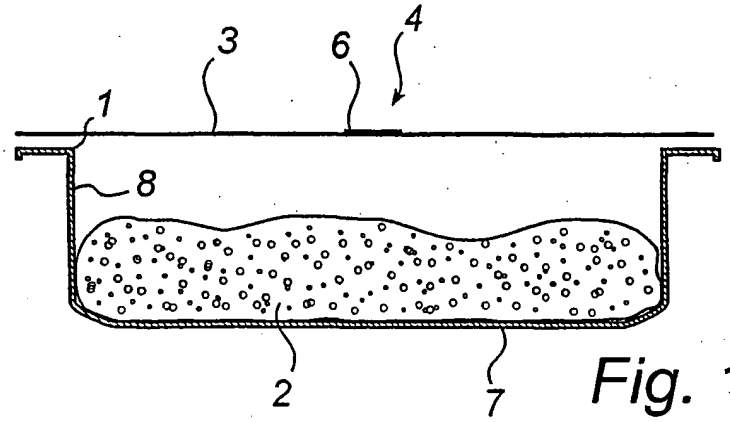

Fig. 1c

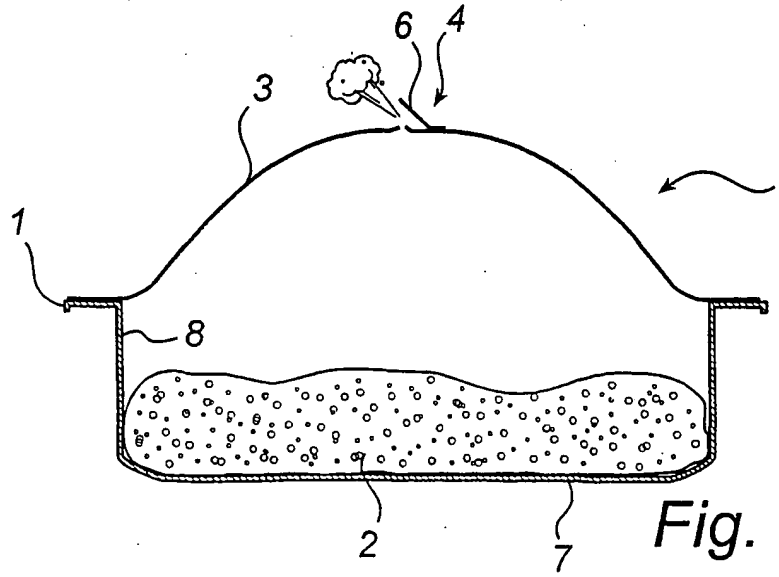

Fig. 1d

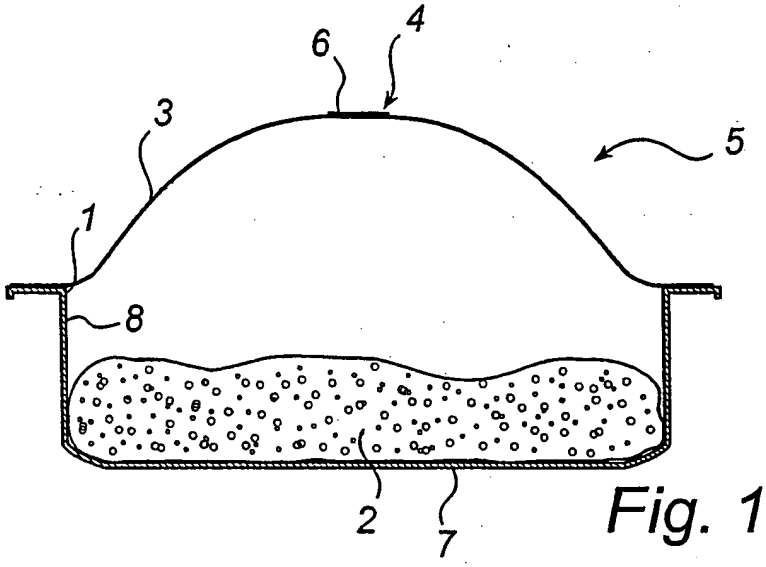

Fig. 1e

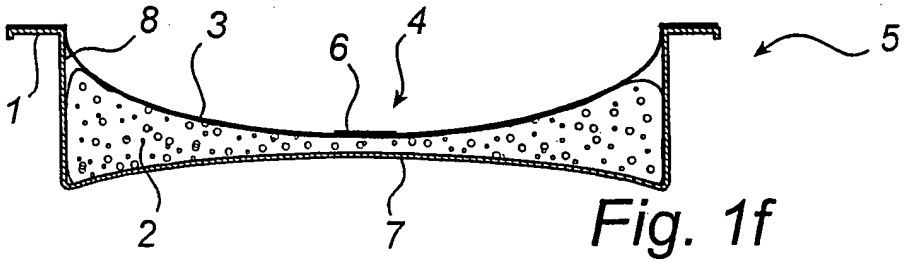

Fig. 1f

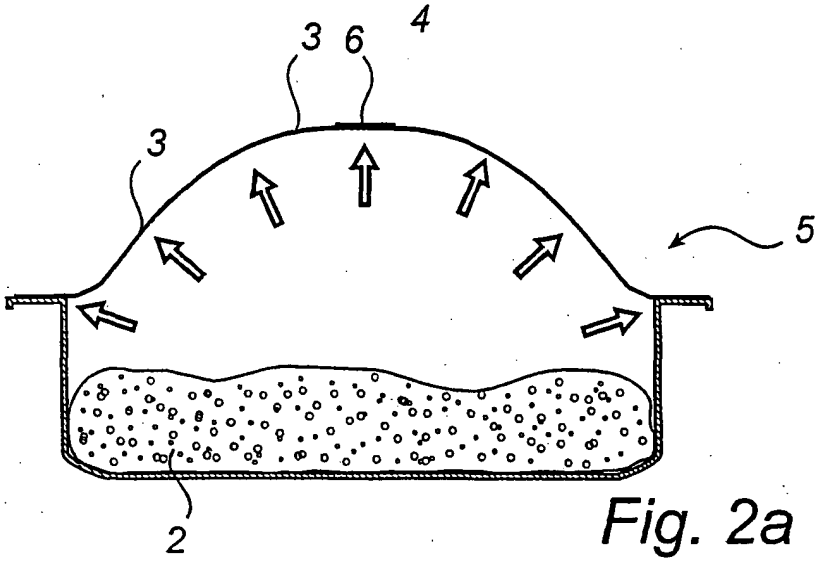

Fig. 2a

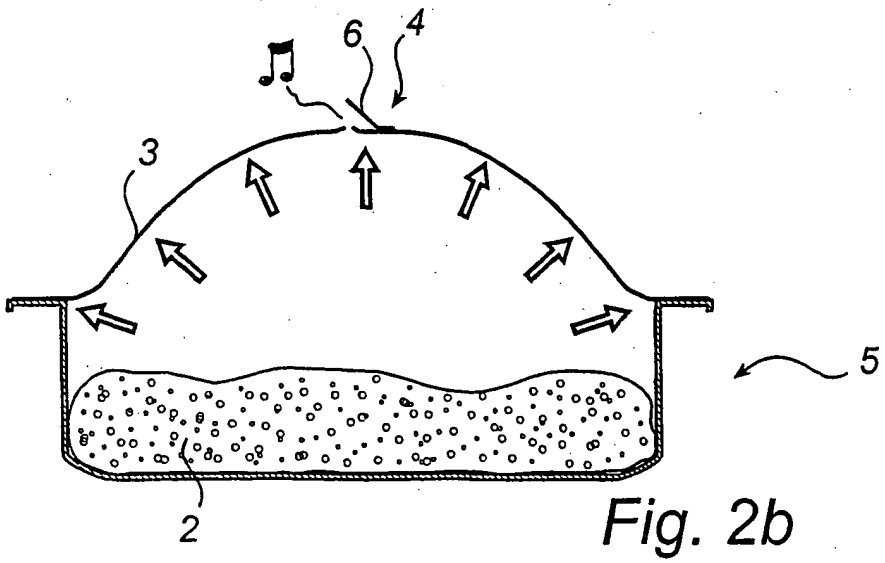

Fig. 2b

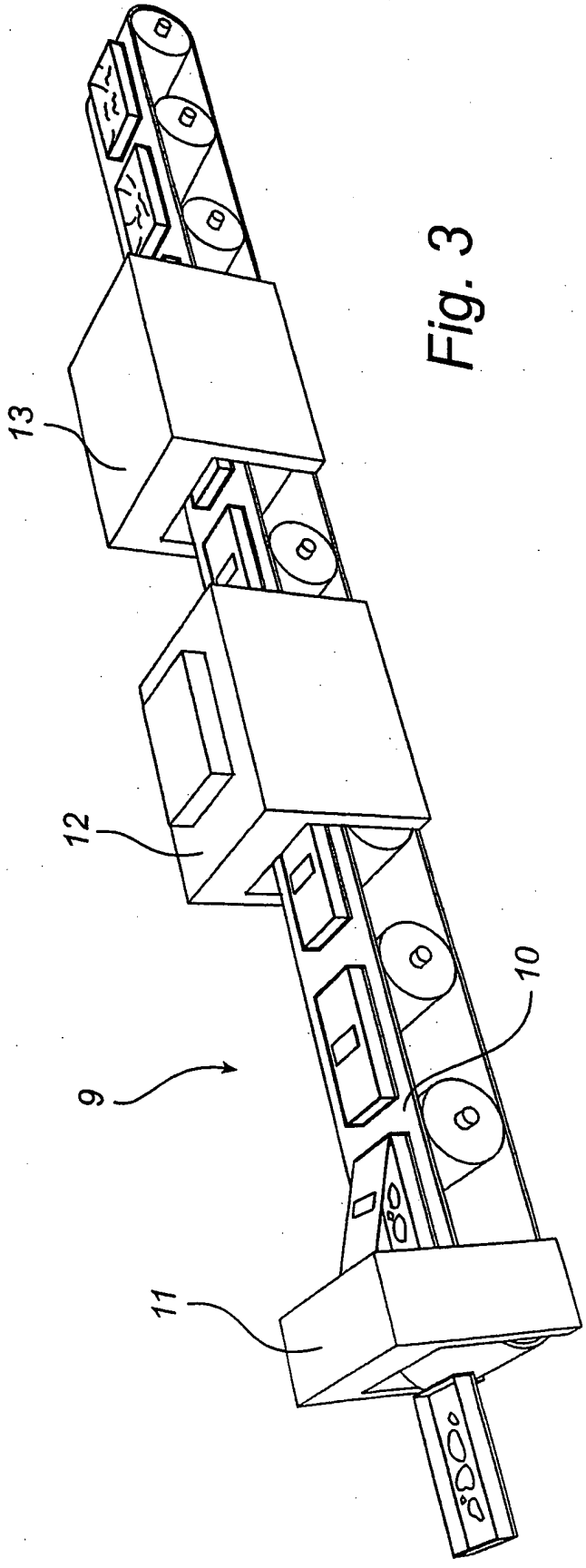

Fig. 3

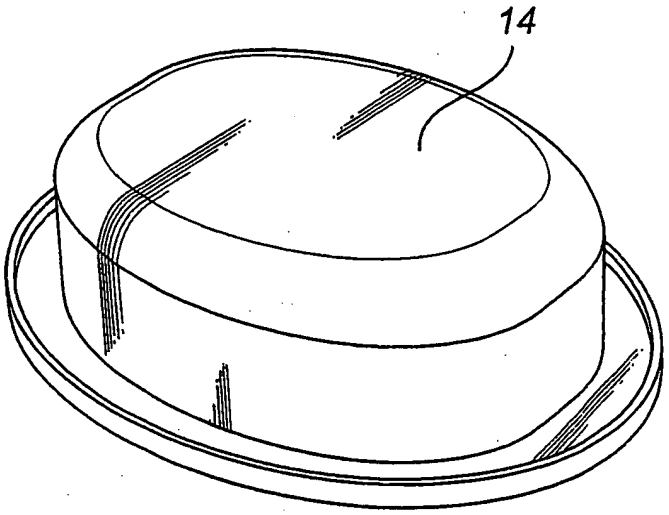

Fig. 4a

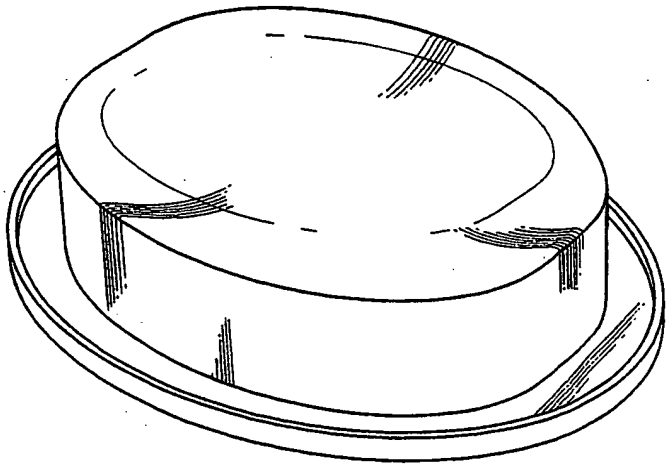

Fig. 4b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 03/01474

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B65D 81/34, A23L 3/10
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B65D, A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4859822 A (JAMES J. RAGUSA ET AL), 22 August 1989 (22.08.89), column 1, line 37 - line 65; column 3, line 5 - line 39; column 4, line 13 - line 34, abstract --	1-12
A	WO 0003605 A1 (HAAMER, JOEL), 27 January 2000 (27.01.00), abstract --	1-12
A	EP 1127810 A2 (HIYOSHI SACHIKO), 29 August 2001 (29.08.01), abstract --	1-12

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 December 2003	04 -12- 2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Inger Löfgren/Els Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

06/09/03

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4859822 A	22/08/89	NONE	
WO 0003605 A1	27/01/00	AU 743208 B	24/01/02
		AU 748914 B	13/06/02
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